Amendments to the Specification:

Please replace paragraph beginning on page 2, line 7 with the following amended paragraph:

In one embodiment of the present invention, a computer program product, encoded in computer readable media, includes program instructions, which, when executed by a processor, are operable to receive input information regarding damaged vehicle components fro at least one vehicle, categorize damage zones with respect to the location of the bumper of a vehicle, categorize a vehicle component with respect to its location on the vehicle, and ~~determine~~ estimate the change in the vehicle's velocity as a result of a collision based on the damaged vehicle components information. The information regarding damaged vehicle components includes particular damaged vehicle components, locations of damaged vehicle components, and an overall vehicle damage rating.

Please replace paragraph beginning on page 2, line 13 with the following amended paragraph:

In a further embodiment, a computer system executing the computer program product is operable to compare the overall vehicle damage rating to a crash test vehicle damage rating, and to determine whether to use crash test data to ~~determine~~ estimate the change in the vehicle's velocity, based on the comparison and the location of damaged components. The executing computer program product further compares characteristics of a damaged vehicle to characteristics of vehicles for which crash test data is available and determines whether crash test data for a particular vehicle is applicable to the damaged vehicle. The executing computer program product then determines a coefficient of restitution to use in estimating the change in the vehicle's velocity.

Please replace paragraph beginning on page 2, line 23 with the following amended paragraph:

In a further embodiment, the executing computer program product is operable to ~~determine~~ estimate the change in the vehicle's velocity based either on the crash data, or the conservation of momentum. The change in vehicle velocity is later input to a multi-method change in velocity combination generator.

Please replace paragraph beginning on page 2, line 27 with the following amended paragraph:

In a further embodiment, the computer program product includes a change in velocity determination module which computationally ~~determines~~ estimates the change in vehicle velocity based on estimates of deformation energy and principal forces. Deformation energy may be estimated using a one way spring model. Principal forces may be estimated based on at least one stiffness parameter and the damage depth information. In a further embodiment the executing computer program product is operable to compare principal forces for at least two vehicles and determine whether the stiffness parameters, the depth information, and/or the principal forces may be adjusted within predetermined thresholds to substantially balance the principal forces.

Please replace paragraph beginning on page 3, line 7 with the following amended paragraph:

In a further embodiment, the executing computer program product is operable to ~~determine~~ estimate closing velocity based on an estimate of a coefficient of restitution. A distribution of changes in velocity may be determined by varying parameters used to ~~determine~~ estimate the change in velocity. Statistical error function in the distribution of changes in velocity may also be estimated and used to vary the parameters. In a further embodiment, distribution of changes in velocity are estimated using stochastic simulation.

Please replace paragraph beginning on page 3, line 18 with the following amended paragraph:

In a further embodiment, the computer program product includes a multi-method change in velocity generator that is operable to ~~determine~~ estimate the change in the vehicle's velocity as a result of a collision based on a plurality of estimation methods including estimation based on one set of crash test data, estimation based on another set of crash test data, and estimation based on conservation of momentum. In a further embodiment, the results of each estimation method are weighted and combined to determine a final estimate for the change in the vehicle's velocity. In a further embodiment, the results for each estimation method may be weighted using a statistical method, such at the t-test.

Please replace paragraph beginning on page 4, line 14 with the following amended paragraph:

In a further embodiment, the method includes comparing the location of damaged components on vehicles involved in the same collision to ~~determine~~ estimate whether to use crash test data to determine the change in at least one of the vehicles' velocity.

Please replace paragraph beginning on page 4, line 26 with the following amended paragraph:

In a further embodiment, the method includes determining a distribution of changes in velocity by varying parameters used to ~~determine~~ estimate the change in velocity and estimating statistical error in the distribution of changes in velocity.

Please replace paragraph beginning on page 6, line 8 with the following amended paragraph:

In most situations, the actual ΔV experienced by a vehicle in a collision ("subject vehicle")is unknown. A ΔV determination module utilizes one or more methodologies to acquire relevant data and estimate the actual ΔV experienced by the subject, accident subject vehicle ("subject vehicle"). The methodologies include ~~determining~~ estimating a subject vehicle ΔV based upon available and relevant crash test information and subject vehicle damage and include a ΔV crush determination module 216 (FIGURE 2) which allows estimation of ΔV from crush energy and computation of barrier equivalent velocities ("BEV")using estimates of residual subject vehicle crush deformation and subject vehicle characteristics. Additionally, conservation of momentum calculations may be used to ~~determine~~ estimate and confirm a ΔV for one or more subject vehicles in a collision. Furthermore, the various methodologies may be selectively combined to increase the level of confidence in a final ~~determined~~ estimated ΔV.

Please replace paragraph beginning on page 7, line 12 with the following amended paragraph:

Referring to FIGURE 2, a ΔV determination module 200 is generally machine readable information disposed in a machine readable medium which may be executed by processor 102 (FIGURE 1). Machine readable media includes nonvolatile memory 108, volatile memory 104, and the electronic data signals used to transfer information to and from I/O device(s) 112, such as a modem. ΔV determination module 200 includes data acquisition module 202 which facilitates receipt of subject vehicle information for determining a subject vehicle ΔV based upon

available and relevant crash test information. As described in more detail below, the information may also be utilized to combine determined subject vehicle ΔV's and adjust stiffness factors used to ~~determine~~ estimate subject vehicle ΔV's in ΔV crush determination module 216.

Please replace paragraph beginning on page 8, line 3 with the following amended paragraph:

A uniform component-by-component damage rating assignment has been developed for, for example, IIHS and CR low velocity crash data and for acquired subject vehicle crash data which allows comparison between the crash test information and the subject accident. The component-by-component damage rating assignment is an exemplary process of uniform damage quantification which facilitates ΔV ~~determinations~~ estimations without requiring highly trained accident reconstructionists.

Please replace paragraph beginning on page 15, line 22 with the following amended paragraph:

In crash test based ΔV determination operation ("crash test ΔV operation") 210, the subject vehicle damage rating is compared to an identical crash test vehicle damage rating, if available, or otherwise to a sister vehicle crash test vehicle damage rating to determine whether or not crash test based ΔV's should be used. As depicted in Table 1, if a subject vehicle overall damage rating is greater than a respective crash test based sister vehicle overall damage rating, the respective crash test information is not used in ~~determining~~ estimating ΔV for the subject vehicle.

Please replace paragraph beginning on page 16, line 2 with the following amended paragraph:

An "A" in Table 5 indicates that the respective crash test based information may be used by crash test ΔV operation 210 to determine a ΔV for the subject vehicle, and an "X" in Table 5 indicates that the subject vehicle received more damage than the IIHS crash test subject vehicles and, thus, the IIHS crash test is not used by crash test ΔV operation 210 to obtain a subject vehicle ΔV. When Group III components in the subject vehicle were damaged, a crash based subject vehicle ΔV is ~~determined~~ estimated by ΔV determination module 200.

Please replace paragraph beginning on page 16, line 19 with the following amended paragraph:

The assignment of ΔV based on crash test comparisons is generally based on the assumption that a bumper-to-bumper impact is simulated by a barrier-to-bumper impact. The barrier-to-bumper impact is a flat impact at the bumper surface along the majority of the bumper width. The bumper-to-barrier impact is a reasonable simulation for the accident if the contact between two subject vehicles is between the bumpers of the subject vehicles along a significant portion of the respective bumper widths, for example, more than one-half width overlap or more than two-thirds width overlap. If any subject vehicle receives only bumper component damage, then a crash based test determined ΔV may be performed based on the outcome of vehicle rating comparisons in Table 1. If the impact configuration entered during execution of data acquisition module 202 includes any damage to any components in zone M, a bumper height misalignment may exist, i.e. override/underride situation. In one embodiment, if components in zone M are damaged, a crash test based ΔV ~~determination~~ estimation will not be directly used for the subject vehicle with damage to any zone M component because the impact force may have exceeded the bumper's ability to protect structures above or beyond the bumper. In another embodiment, if components in zone M receive only minor or insubstantial damage, such as headlight or taillight glass breakage, a crash test based ΔV ~~determination~~ estimation will be used in multi-method ΔV combination generator 232.

Please replace paragraph beginning on page 17, line 30 with the following amended paragraph:

Crash test vehicle information is utilized by crash test ΔV operation 210 to ~~determine~~ estimate a subject vehicle ΔV if the crash test vehicle is identical or similar ("sister vehicle") to the subject vehicle. To determine if a crash test vehicle is a identical or a sister vehicle to the subject vehicle, damage on a component by component basis can be determined, and, if components remain the same over a range of years, the crash test information may be extended to crash test results over the range of years for which the bumper and its components have remained the same. Mitchell's Collision Estimating Guide (1997) ("Mitchell") by Mitchell International, 9889 Willow Creek Road, P.O. Box 26260, San Diego, Calif. 92196 and Hollander Interchange ("Hollander") by Automatic Data Processing (ADP) provide repair estimate

information on a subject vehicle component level. The parts are listed individually and parts remaining the same over a range of years are noted in Mitchell and Hollander.

Please replace paragraph beginning on page 20, line 12 with the following amended paragraph:

The crash based ΔV's for each vehicle are used to ~~determine~~ estimate a ΔV for the other vehicle. For example, the crash based ΔV's for a first subject vehicle are inserted as ΔV_1 in equation 1 and used by conservation of momentum operation 212 to ~~determine~~ estimateΔV's for the second subject vehicle, and visa versa. The ΔV's ~~determined~~ estimated by conservation of momentum operation 212 for the two subject vehicles are compared to the ΔV's ~~determined~~ estimated by crash test ΔV operation 210, respectively, in conservation of momentum based/crash test based ΔV comparison operation 213. If the ΔV's from crash test ΔV operation 210 and conservation of momentum operation 212 are in closer agreement for the first subject vehicle than the similarly compared ΔV's for the second subject vehicle, then ΔV's ~~determined~~ estimated in crash test ΔV operation 210 for the second subject vehicle are used in multi-method ΔV combination generator 232, and the conservation of momentum operation 212 based ΔV's are utilized in multi-method ΔV combination generator 232 for the first subject vehicle. Likewise, if the ΔV's from crash test ΔV operation 210 and conservation of momentum operation 212 are in closer agreement for the second subject vehicle than the similarly compared ΔV's for the first subject vehicle, then ΔV's ~~determined~~ estimated in crash test ΔV operation 210 for the first subject vehicle are used in multi-method ΔV combination generator 232, and the conservation of momentum operation 212 based ΔV's are utilized in multi-method ΔV combination generator 232 for the second subject vehicle.

Please replace paragraph beginning on page 21, line 1 with the following amended paragraph:

If only one of the subject vehicles has an applicable crash test(s), the ΔV's ~~determined~~ estimated in crash test ΔV operation 210 are used by conservation of momentum operation 212 to ~~determined~~ estimated the ΔV's for the other subject vehicle using equation 1 as described above.

Please replace paragraph beginning on page 21, line 5 with the following amended paragraph:

Data Acquisition for Computationally ~~Determined~~ Estimated ΔV

Please replace paragraph beginning on page 21, line 6 with the following amended paragraph:

As discussed in more detail below, the ΔV determination module 200 utilizes a ΔV data acquisition module 214 to estimate ΔV for a subject vehicle in addition to the above described crash test based ΔV ~~determination~~ estimation. The ΔV computation module utilizes data input from users in the ΔV data acquisition module 214. Conventionally, the Campbell method provides an exemplary method to calculate subject vehicle ΔV; see Campbell, K., *Energy Basis for Collision Severity, Society of Automotive Engineers* Paper #740565, 1974, which is incorporated herein by reference in its entirety. Data entry used for conventional programs to determine ΔV generally required knowledge of parameters used in ΔV calculations and generally required the ability to make reasonable estimates and/or assumptions in reconstructing the subject vehicle accident.

Please replace paragraph beginning on page 23, line 29 with the following amended paragraph:

In addition to or as an alternative to the interactive displays described herein, information regarding the damaged components on one or more vehicles may be entered in a data file that is later read by computer instructions for use in ~~determining~~ estimating ΔV. A voice recognition system may also be used for data entry. Further, sensor systems may be used to provide information to the data acquisition module 214 regarding damage to components of a vehicle. Such sensor systems may utilize one or more of a variety of sensing technologies and would provide relatively accurate information regarding the severity of the damage. For example, a sensor system provides a map of damage depth versus location that is used to analyze force and direction of impact. Sensor systems also provide information regarding damage to components that are hidden from view. Severity of damage may also be determined by using computerized imagery from one or more photographs and/or sensor system images of the vehicle damage. Information regarding the location and line of sight of the camera and/or sensor system, and the location and orientation of the vehicle with respect to a reference is provided. Crush profiles are

generated by the computer utilizing trigonometric calculations and/or image recognition/comparison techniques.

Please replace paragraph beginning on page 24, line 13 with the following amended paragraph:

Computational ~~Determination~~ Estimation of ΔV Based on Subject Vehicle Crush Depth or Induced Damage

Please replace paragraph beginning on page 24, line 15 with the following amended paragraph:

A ΔV determination module based on subject vehicle crush depth or induced damage ("ΔV crush determination module") 216 determines the amount of energy required to produce the damage acquired by ΔV data acquisition module 214. If there is no crush in a subject vehicle, the ΔV crush determination module 216 will ~~calculate~~ estimate a "crush threshold" energy, i.e. the amount of energy required to produce crush. If neither subject vehicle has crush, then the ΔV crush determination module 216 will generate a crush threshold energy analysis for both subject vehicles in a collision in accordance with equation 000:

$$E = \frac{A^2}{2B} W_C .$$

Please replace paragraph beginning on page 24, line 26 with the following amended paragraph:

The lowest energy, E, determined by ΔV crush determination module 216 with equation 000 is chosen as an upper bound for the energy of the other subject vehicle, since the subject vehicle with the lowest crush threshold energy was not damaged. W_c of the vehicle with the larger energy is reduced until an energy balance is achieved. ΔV's for the respective subject vehicles are then ~~determined~~ estimated by determining BEV from equation 10 and ΔV is ~~determined~~ estimated from equation 5 from BEV.

Please replace paragraph beginning on page 25, line 11 with the following amended paragraph:

As described in more detail below, the ΔV crush determination module 216. enables the estimation of crush energy, computation of BEV's, and, ultimately, estimated ΔV's of subject

vehicles from estimates of residual subject vehicle crush deformation and subject vehicle characteristics supplied by ΔV data acquisition module 214.

Please replace paragraph beginning on page 25, line 24 with the following amended paragraph:

BEV's can be calculated for each subject vehicle separately using the crush dimension estimates from ΔV data acquisition module 214 and subject vehicle stiffness factors for the damaged area. However, a BEV is not the actual ΔV experienced at the passenger compartment in a barrier collision. Nor are BEV's calculated from crush energy estimates appropriate measures of ΔV's in two-car collisions. In order to employ BEV estimates for calculating ~~ΔV's~~ ΔV estimates the subject vehicles should approximately achieve a common velocity just prior to their separation. Further, the degree of elasticity of the collision should be known or accurately estimated to achieve reasonably good estimates of actual ΔV's in either barrier or subject vehicle-to-subject vehicle collisions. Conservation of energy and momentum apply to all collisions.

Please replace paragraph beginning on page 28, line 13 with the following amended paragraph:

Caution should be employed when using the "zero deformation" energy value as it is sometimes based on assumption of a "no damage" or "damage threshold" ΔV. The A and B stiffness coefficient values are calculated in a well-known manner from linear curve fits of energy versus crush depth measured in staged barrier impact tests. A and B values are estimated using NHTSA, IIHS and/or Consumer Reports crash tests for vehicles that have been tested by these organizations. A and B values are also available from data in Siddall and Day, Updating the Vehicle Class Categories, #960897, Society of Automotive Engineers, Warrendale, Pa, 1996 ("Siddall and Day"). However, ΔV crush determination module 216 assigns relatively low confidence to "no damage" ~~ΔV's~~ ΔV estimates calculated from crush energy. Standard deviations for the stiffness coefficients can be used to estimate the degree of variation in the parameters within a particular class. Siddall and Day also provide standard deviations for estimating variation. This data is employed by ΔV crush determination module 216 to estimate confidence intervals for the energy and ΔV estimates calculated for a particular subject vehicle when using the stiffness data for its size class.

Please replace paragraph beginning on page 33, line 14 with the following amended paragraph:

When there is no damage to either subject vehicle, the ΔV's are calculated using the lower of the two principal forces and using a crush depth of zero. The contact width of the subject vehicle with the larger force is reduced until force balance is achieved after which crush energy and ΔV's are ~~calculated~~ estimated in the same manner as for vehicles with residual crush.

Please replace paragraph beginning on page 36, line 15 with the following amended paragraph:

Thus the ΔV determination error operation 226 characterizes the error in the ~~ΔV~~ ΔV estimate calculations in order to obtain a distribution of ΔV's. The values of the subject vehicle weights, stiffness factors A and B, crush widths, crush depths, and a coefficient of restitution, e, parameters employed in ΔV crush determination module 216 are all likely to be in error to some degree. The essence of the problem of estimating error in ΔV calculations is, thus, related to estimating the error in the individual parameters and the propagation of that error through the mathematical manipulations required to calculate ΔV. Estimates of the error in individual parameters are available for the stiffness parameters. However, estimates of error for the other parameters are not available in the literature except for the stiffness parameter standard deviations supplied by Siddal and Day pp. 271-280 and particularly page 276.

Please replace paragraph beginning on page 54, line 10 with the following amended paragraph:

If the t-test fails, i.e. determines that the ~~find the~~ ΔV crush determination module 216 based populations and the crash test ΔV operation 210 based populations are of different populations, the ΔV crush determination module 216 based distribution is not used and the multi-method ΔV combination generator 232 uses the crash test ΔV operation 210 based distribution(s) only.

Please replace the Abstract beginning on page 66, line 8 with the following amended paragraph:

A system and method that utilizes information relating to vehicle damage information including damaged vehicle area information, crush depth of the damaged areas information, and vehicle component-by-component damage information to ~~determine~~ estimate the relative velocities of vehicles involved in a collision. The change in velocity is estimated using a

plurality of methods, and a determination is made as to which method provided a result that is likely to be more accurate, based on the damage information, and the types of vehicles involved. The results from each method may also be weighted and combined to provide a multi-method estimate of the closing velocity. The methods include using crash test data from one or more sources, estimating closing velocity based on the principals of conservation of momentum, and estimating closing velocity based on deformation energy resulting from the collision.